

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 10/693,584 Confirmation No.: 1077
Applicant(s) : Baiyi ZHAO et al.
Filed : October 24, 2003
TC/A.U. : 1793
Title : *Late Transition Metal Catalysts for Olefin Oligomerizations*
Examiner : James E. McDONOUGH
Docket No. : 2002B130/2
Customer No. : 23455
Date : December 23, 2009

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF SUBMITTED UNDER 37 C.F.R. § 41.31

This Appeal Brief is filed within four months of a previous notice of appeal filed on September 4, 2009. A petition for a two month extension of time is attached hereto. In the event it becomes separated from this appeal brief, the Commissioner is authorized to debit deposit account number 05-1712 for the necessary fees to make this paper timely.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is ExxonMobil Chemical Patents, Inc., assignee of record, which is a wholly owned affiliate of Exxon Mobil Corporation.

II. RELATED APPEALS AND INTERFERENCES

There is one related appeal or interference. USSN 10/692,827, filed October 24, 2003 is also appealed. No decisions have been reached as of the filing date of this Brief.

III. STATUS OF THE CLAIMS

As of the filing date of this appeal brief:

Claims 2-6, 9-11, and 13-17 stand rejected.

Claims 18-33 are withdrawn.

Claims 1, 7, 8, 12 have been cancelled.

The rejection of claims 2-6, 9-11, and 13-17 is appealed.

IV. STATUS OF THE AMENDMENTS

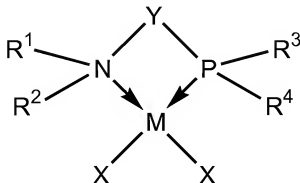
Applicant's Amendment dated September 25, 2008 has been entered.

There is one amendment, filed concurrently with this Brief, which has not been entered.

There are no other amendments that have not been entered.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention as claimed is directed to a catalyst compound useful in olefin oligomerization and or polymerization represented by the formula:



wherein

M is iron, cobalt, or nickel; N is nitrogen; P is phosphorus; R^1 , R^2 , R^3 , and R^4 are hydrocarbyl radicals; Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclododecylene, cyclotetradecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals; and (f) each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate; or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

The description of Applicant's catalyst compound is found at pages 6 to 14, and the originally filed claims, particularly originally filed claims 2-17 of the specification as filed.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The rejections to be reviewed on appeal are:

1. Whether the catalyst compounds described in claims 2-6 and 13-17 are anticipated under 35 U.S.C. § 102(b) over US 6,307,087 ("Buchwald").
2. Whether the catalyst compounds described in claims 9 and 10 are obvious under 35 U.S.C. § 103(a) over US 6,307,087 ("Buchwald") in further view of US 2001/0044508 ("Loveday").
3. Whether the catalyst compounds described in claim 10 are obvious under 35 U.S.C. § 103(a) over US 6,307,087 ("Buchwald") in further view of US 7,199,075 ("Speiser").
4. Whether the catalyst compounds described in claim 11 are obvious under 35 U.S.C. § 103(a) over US 6,307,087 ("Buchwald") in further view of US 4,377,528 ("Beach").
5. Whether the catalyst compounds described in claims 2-6 and 9-17 are obvious under the judicially created doctrine of obviousness-type double patenting over claims 1-10, 12, 13, 15-20, 28-31 and 36-40 of USSN 10/692,827, filed October 24, 2003.
6. Whether claims 13 and 14 are indefinite under 35 USC § 112, second paragraph.

VII. ARGUMENT

The art relied upon in the rejection of the claims under appeal is listed below:

1. US 6,307,087 ("Buchwald");
2. US 2001/0044508 ("Loveday");
3. US 7,199,075 ("Speiser");
4. US 4,377,528 ("Beach"); and
5. USSN 10/692,827

Argument in Response to Rejection I.

Claims 2-6 and 13-17 are rejected under 35 USC § 102(a) as being anticipated by Buchwald (US 6,307,087). Specifically, the Examiner cites the abstract, column 32, line 22-32, and column 7, lines 5-45. Applicant respectfully disagrees.

To anticipate a claim under 35 USC § 102, a single prior art reference must expressly or inherently disclose each claim limitation. However, simple disclosure of each element is not quite enough. The Federal Circuit has long held that "[a]nticipation requires the presence in a single prior art disclosure of all elements of a claimed invention *arranged as in the claim*." (*Net MoneyIN, Inc. v. Verisign, Inc.*, 88 USPQ2d 1751 (Fed. Cir., 2008) at 1759,

(quoting *Finisar Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323 quoting *Connell*, 722 F.2d at 1548).

Recently, this October 2008 in fact, the Federal Circuit has reaffirmed this stating in *Net MoneyIN*, "We thus hold that unless a reference discloses within the four corners of the document not only all of the limitations claimed but also all of the limitations arranged or combined in the same way as recited in the claim, it cannot be said to prove prior invention of the thing claimed and, thus, cannot anticipate under 35 U.S.C. §102."

In the instant application, Applicant submits that: 1) Buchwald does not disclose Applicant's specifically claimed invention, and 2) nothing within the Buchwald discloses, teaches or suggests that one select Applicant's *specific combination* of claim requirements of *inter alia*, a metal atom specifically of iron, cobalt or nickel bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom and thus Buchwald art does not anticipate the claimed invention.

It is also interesting to note that the Examiner has previously rejected the claimed invention under 35 USC § 102(b) over Buchwald and withdrawn that rejection in the office action of February 22, 2008.

In light of the above Applicant respectfully requests the rejection be withdrawn.

Argument in Response to Rejection 2.

Claims 9-10 are rejected under 35 USC § 103(a) as being unpatentable over Buchwald (US 6,307,087) in view of Loveday (US 2001/0044508).

As stated in MPEP § 2141, the criteria set out in Graham v. John Deere (383 US 1, 148 USPQ 459(1966)) are used to assess obviousness. These are "...the scope and content of the prior art are to be determined, differences between the prior art and the claims at issue are to be ascertained and the level of ordinary skill in the pertinent art resolved."

The scope and content of the prior art: Buchwald discloses ligand-metal complexes and methods to use them in small molecule reactions, such as Suzuki coupling, amination, diaryl ether synthesis, ketone arylation and Heck reactions (Buchwald Figure 1, column 1, line 65- to column 2, line 1). Buchwald is for use in small molecular synthesis and does not

relate to olefin oligomerizations/polymerizations and catalyst compounds for such. Loveday discloses a dual catalyst system for making bimodal polymers.

The differences between the prior art and the claims at issue: Applicants claimed invention as a whole relates to a metal atom specifically of iron, cobalt or nickel bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom, where a hydrocarbyl bridge connects the nitrogen and phosphorus atoms. This compound is useful for olefin polymerization, not small molecule reactions.

Applicant's claimed invention differs from the prior art in that the prior art alone (or in combination) does not disclose the combination of a metal atom specifically of iron, cobalt or nickel bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom where a hydrocarbyl bridge connects the nitrogen and phosphorus atoms and its use as a polymerization catalyst.

The level of ordinary skill in the pertinent art: With regard to the level of skill in the art, it has long been established that catalysis is generally considered unpredictable merely from the chemical nature of the catalyst. Corona Co. V. Dovan (USSC 1928) 276 US 358, 369. Catalytic effects are not ordinarily predictable with certainty. In re Doumani et al. (CCPA 1960) 281 F.2d 215, 126 USPQ 408.

The Examiner suggests that Buchwald's abstract, column 32, line 22-32, and column 7, lines 5-45 discloses a halogenated compound within Applicant's claims 2-6 and 13-17 and that Loveday discloses the substitution of halogens for functionally equivalent mono-anionic labile ligands, thus making claims 9 and 10 obvious. Applicant respectfully disagrees.

Applicant submits that the mere disclosure in Buchwald of a series catalyst ligands and metals necessarily does not mean that they must coordinate and/or operate in the same way as Applicant's claimed catalyst-metal complex. Applicant has previously shown, not only based on scientific arguments, but buttressed with disclosure in published prior art documents, how such complexation between metal and ligand in the cited prior art is not inherent and thus not predictable. Applicant has made these points most recently in the Canich Declaration previously submitted in July of 2008. The Canich Declaration is sworn evidence that has not been given due weight by the Examiner. In particular, paragraph 6 of

the Canich Declaration describes why the Examiner's hypothesis that Buchwald anticipates the claimed invention is incorrect. The Examiner relies on the combination of a metal precursor (e.g. $\text{NiCl}_2[\text{P}(\text{C}_6\text{H}_5)_2]_2$) and "a ligand reading on the limitation of the instant claims in general structure 4, where certain embodiments include R_1 and R_2 are hydrogen (col. 7, lines 5-45), reading on Y being biphenyl" to form a composition of matter of claim 1 of the instant application. The Examiner gives no unequivocal reference that such a reaction would or could take place, while Canich's declaration in paragraph 6 cites several references which scientifically show the structure of the corresponding palladium complex to be a structure different from the claimed invention. Buchwald states "Catalysts containing palladium and nickel are preferred. It is expected that these catalyst will perform similarly because they are known to undergo similar reactions, namely oxidative-addition reactions and reductive-elimination reactions which are thought to be involved in the formation of the products of the present invention" (col 31, lines 40-45, emphasis added). Hence Buchwald, in combination with the three references cited in paragraph 6 of Canich's declaration would imply a combination of a nickel based metal precursor with a ligand as described by the Examiner would form a complex outside the scope of claim 1 of the instant application. Furthermore, of the 58 examples in Buchwald, not a single example uses a nickel compound or nickel precursor compound. Buchwald never purposely or accidentally made the complex of claim 1, and teaches away from the complex of claim 1 by inferring that the chemistry of nickel and palladium are similar. Further, Loveday relates to polymerization catalysts. One of ordinary skill in the art would not think to combine a *small molecule* catalyst of Ni or Pd with parts of a *polymerization* catalyst. Buchwald's catalysts make small molecules, e.g. amination, arylation. Buchwald does not make a completely different material, like Applicant's polymers. This is an important distinction because as a general rule small molecule catalysts change a single molecule in some way (aminate it, arylate it, etc) whereas oligomerization/polymerization catalysts take multiple molecules and string them together into chains with multimeric repeat units (typically on the order of 10's to 1000's or even 10,000's of units or more). This is a fundamentally different way of performing chemistry. One of ordinary skill in the art does not look to a coupling catalyst or amination catalyst to make a polymer or oligomer. As evidence to support this conclusion please see the Dr. Canich's declaration attached hereto.

Finally, the Examiner has offered no basis, and Applicant can also find no basis in the record, for combination of a concept applicable to catalytic complexes for making olefin polymers (Loveday) with late transition metal-diphosphine/phosphoamine ligand complexes disclosed for functionalized compounds or asymmetrically substituted small molecules (Buchwald). As such, even the combination of Buchwald and Loveday does not disclose or suggest all the elements of the currently pending claims and thus does not render obvious the claimed invention.

Applicant respectfully submits that the Examiner cannot merely cite portions of references and generalize their applicability to cobble together a rejection asserting that a selective combination of such scattered elements (or, even worse, a combination of such scattered elements and some elusive knowledge of an alleged skilled artisan) without a motivation or suggestion for one of ordinary skill in the art to do so. The number of elements of the cited prior art that one of ordinary skill in the art would have had to ignore, alter, generalize, or reason away in contradiction of the references themselves in order to attain the claimed invention seems to be more than the number of elements from the cited prior art on which the Examiner relies to render obvious the claimed invention. Applicant also asserts that, even if such a combination of elements from the prior art were somehow supported by scientific rationale on the record, Applicant's sworn testimony offering scientific rationale to rebut the Examiner's rationale is not given due weight nor appropriately rebutted on the record. If the Examiner wishes to contest the validity of statements made in this Declaration, it is proper that he do more than offer mere Examiner argument or conclusory statements to do so – he must take Official Notice, cite published prior art contradicting this sworn testimony, or offer contradictory sworn testimony based on clear scientific reasoning (*e.g.*, in the form of a declaration or affidavit), if he wishes to cast sufficient doubt over its validity to put the burden of proof back on Applicant. *See In re Zurko*, 258 F.3d 1379, 1385, 59 USPQ2d 1693, 1697 (Fed. Cir. 2001) (“[T]he Board [or an examiner] cannot simply reach conclusions based on its own understanding or experience or on its assessment of what would be basic knowledge or common sense. [T]he Board [or an examiner] must point to some concrete evidence in the record in support of these findings [to satisfy the substantial evidence test]. If the examiner is relying on personal knowledge to support the finding of what is known in the art, the examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. The Board [or an

examiner] cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies.”) (Emphasis added); *see also* M.P.E.P. § 2144.03. Thus, the Examiner cannot ignore the Canich Declaration simply because he disagrees with it. The Declaration, particularly this declaration which is supported by scientific reasoning *in the declaration*, must be considered as evidence by the Examiner and not summarily dismissed. Applicant respectfully submits that Dr. Canich's conclusions, supported by clear and unchallenged reasoning, takes precedence over the Examiner's conclusory statements.

Argument in Response to Rejection 3.

Claim 10 is rejected under 35 U.S.C. § 103(a) as obvious over U.S. 6,307,087 (“Buchwald”) in further view of U.S. 7,199,075 (“Speiser”).

As noted above, Applicant submits that the claimed invention is neither anticipated nor obvious from Buchwald because: 1) Buchwald does not disclose Applicant's specifically claimed invention, 2) nothing within the Buchwald discloses, teaches or suggests that one select Applicant's *specific combination* of claim requirements of *inter alia*, a metal atom specifically of iron, cobalt or nickel bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom; and 3) Buchwald's catalysts make small molecules, e.g. amination, arylation, not polymers or oligomers.

Speiser, like Loveday's polymerization catalysts above, does not cure these defects. Speiser discloses an oligomerization catalyst. One of ordinary skill in the art would not think to combine a *small molecule* catalyst of Ni or Pd with *parts* of an *oligomerization* catalyst. Buchwald's catalysts make small molecules, e.g. amination, arylation. Buchwald does not make a completely different material, like Applicant's polymers. This is an important distinction because as a general rule small molecule catalysts change a single molecule in some way (aminate it, arylate it, etc) whereas oligomerization/polymerization catalysts take multiple molecules and string them together into chains with multimeric repeat units (typically on the order of 10's to 1000's or even 10,000's of units or more). This is a fundamentally different way of performing chemistry. One of ordinary skill in the art does not look to a coupling catalyst or amination catalyst to make a polymer or oligomer. Thus, Applicant submits that the motivation to combine these references fails and requests the rejection be withdrawn.

Argument in Response to Rejection 4.

Claim 11 is rejected under 35 U.S.C. § 103(a) as obvious over US 6,307,087 ("Buchwald") in further view of US 4,377,528 ("Beach").

As noted above, Applicant submits that the claimed invention is neither anticipated nor obvious from Buchwald because: 1) Buchwald does not disclose Applicant's specifically claimed invention, 2) nothing within the Buchwald discloses, teaches or suggests that one select Applicant's *specific combination* of claim requirements of *inter alia*, a metal atom specifically of iron, cobalt or nickel bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom; and 3) Buchwald's catalysts make small molecules, e.g. amination, arylation, not polymers or oligomers.

Beach, like Loveday's and Speiser's polymerization and oligomerization catalysts above, does not cure these defects. Beach discloses oligomerization catalysts (Column 8, line 52). One of ordinary skill in the art would not think to combine a *small molecule* catalyst of Ni or Pd with parts of an *oligomerization* catalyst. Buchwald's catalysts make small molecules, e.g. amination, arylation. Buchwald does not make a completely different material, like Applicant's polymers. This is an important distinction because as a general rule small molecule catalysts change a single molecule in some way (aminate it, arylate it, etc) whereas oligomerization/polymerization catalysts take multiple molecules and string them together into chains with multimeric repeat units (typically on the order of 10's to 1000's or even 10,000's of units or more). This is a fundamentally different way of performing chemistry. One of ordinary skill in the art does not look to a coupling catalyst or amination catalyst to make a polymer or oligomer. Thus, Applicant submits that the motivation to combine these references fails and requests the rejection be withdrawn.

Argument in Response to Rejection 5.

Claims 2-6 and 9-17 have been rejected under the judicially created doctrine of obvious type double patenting (ODP) over claims 1-10, 12, 13, 15-20, 28-31 and 36-40 of USSN 10/692,827, filed October 24, 2003. Applicant respectfully disagrees.

First, Applicant notes that the instant rejection was made and *subsequently withdrawn* by the Examiner in the office action dated February 22, 2008. Specifically on page 3 the Examiner stated that Applicant's argument against the ODP rejection was persuasive and

withdrew the rejection. No reason has been given as to why the same ODP rejection has been reinstated.

Second, Applicant notes that a similar rejection is made in USSN 10/692,827, over the instant application. Applicant further notes that, with regard to obviousness type double patenting rejections, if the applications have the same effective filing date (which 10/692,827 and the instant application do) according to MPEP § 804 I.B.1, *“the examiner should determine which application claims the base invention and which application claims the improvement (added limitations). The ODP rejection in the base application can be withdrawn without a terminal disclaimer.”* Applicant respectfully requested that the Examiner make the determination of which application is the "base" application and which application is the "improvement" application. The Examiner refused to do so.

Applicant submits that the instant Application is the base application for purposes of MPEP § 804 I.B.1, and the OPD rejection in the instant application should be withdrawn and the instant application passed to issue without a terminal disclaimer.

Third, Applicant notes that the claims in 10/692,827 are to a catalyst system (e.g. the compound and the activator) not to the catalyst compound alone, while the claims in the instant application are to the compound. The Examiner forced Applicant to withdraw similar claims in the instant application drawn to a catalyst system (Invention II) in the office action date November 5, 2005. It is inconsistent for the Examiner to say that the *catalyst system* claims in the instant application are patentably distinct and must be withdrawn, yet the *catalyst system* claims in another application are not. Applicant respectfully requests that the rejection be withdrawn.

Further, Applicant notes that claims 1-40 in USSN 10/692,827 have been cancelled. Thus the rejection is moot and should be withdrawn.

Argument in Response to Rejection 6.

Applicant has amended claims 13 and 14 to depend from claim 2 in an amendment submitted concurrently with this Appeal Brief. Applicant requests the amendment be entered. A copy of the amendment is attached as APPENDIX XI.

Prayer

Applicant respectfully requests that the rejections under the doctrine of obviousness-type double patenting, 35 USC § 102 and 35 USC § 103 be withdrawn, and the claim is passed to issue.

Respectfully submitted,

December 23, 2009

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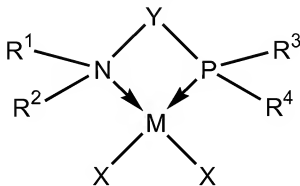
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VIII. APPENDIX: Listing of Claims:

Listing of Claims: AS AMENDED on January 14, 2009

This listing does not include the proposed amendment to claims 13 and 14 submitted concurrently with this Appeal Brief.

1. (Cancelled)
2. (Previously Presented) A composition of matter with the following formula:



wherein

M is iron, cobalt, or nickel;

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are hydrocarbyl radicals;

Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclododecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene,

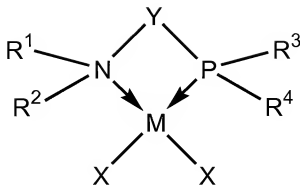
pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals; and
 (f) each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate; or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

3. (Previously Presented) The composition of matter of Claim 2 wherein R^1 , R^2 , R^3 , and R^4 are C_1 - C_{40} hydrocarbyls.

4. (Previously Presented) The composition of matter of Claim 3 wherein R^1 , R^2 , R^3 , and R^4 are C_1 - C_{30} hydrocarbyls.

5. (Previously Presented) The composition of matter of Claim 4 wherein R^1 , R^2 , R^3 , and R^4 are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

6. (Previously Presented) The composition of matter of Claim 5 wherein R^1 , R^2 , R^3 , and R^4 are methyl, ethyl, propyl, butyl, cyclohexyl, phenyl, tolyl, benzyl, or phenethyl.
7. (Cancelled)
8. (Cancelled)
9. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are dimethylamino, diethylamino, methylethylamino, phenoxy, or benzoxy.
10. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, or tolyl.
11. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently allyl, or 1,1-dimethyl allyl.
12. (Cancelled)
13. (Previously Presented) The composition of matter of Claim 12 wherein M is nickel.
14. (Previously Presented) The composition of matter of Claim 12 wherein both X groups are a chloride, bromide or iodoide.
15. (Previously Presented) The composition of matter of Claim 2 wherein Y is biphenyl.
16. (Previously Presented) A composition of matter with the following formula:



wherein

M is nickel, cobalt or iron,

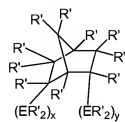
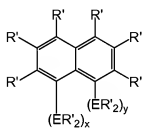
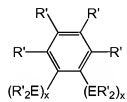
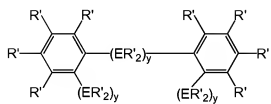
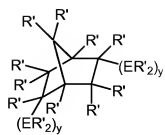
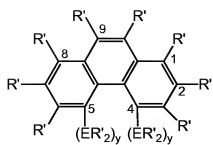
N is nitrogen;

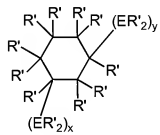
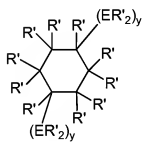
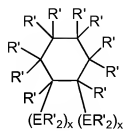
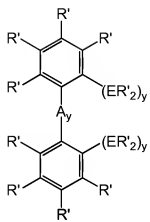
P is phosphorus;

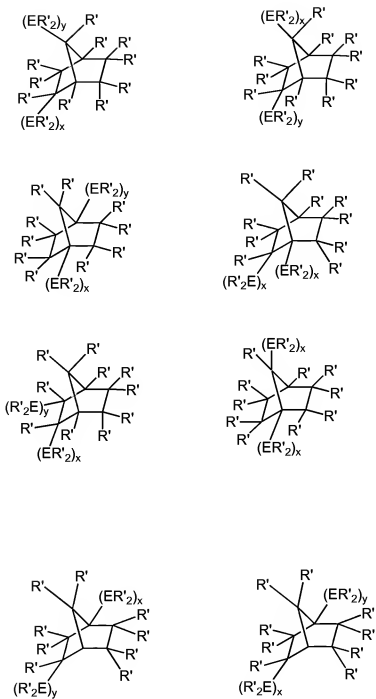
R¹, R², R³, and R⁴ are hydrocarbyl radicals;

each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate, or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene; and

Y has one of the following formulas:







where

R' are hydrogen or C₁-C₅₀ hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4; and

y is an integer from 0 to 4.

17. (Previously Presented) The composition of Claim 16 wherein A is C=O, C=S, O, S, SO₂, NR*, PR*, BR*, SiR*₂, or GeR*₂ wherein each R* is a hydrocarbyl or halocarbyl radical.

18. (Withdrawn) A composition of matter comprising the reaction product of an activator and the composition of matter of Claim 2.

19. (Withdrawn) A composition of matter comprising the reaction product of

- (a) the composition of matter of Claim 18 and
- (b) ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

20. (Withdrawn) A polymerization method comprising the step of providing at least one composition of matter of Claim 2.

21. (Withdrawn) The polymerization method of Claim 20 wherein the activity of the composition of matter exceeds 8000 moles of ethylene per mole transition metal per hour.

22. (Withdrawn) The polymerization method of Claim 20 further comprising recovering a product comprising greater than 50 wt% of linear C₄-C₁₄ α-olefins based on the total weight of polymerized product.

23. (Withdrawn) The polymerization method of Claim 22 wherein the product comprises greater than 80 wt% of linear C₄-C₁₄ α-olefins.

24. (Withdrawn) The polymerization method of Claim 23 wherein the product comprises greater than 50 wt% of linear C₄ and C₆ α-olefins.

25. (Withdrawn) The polymerization method of Claim 24 wherein the product comprises greater than 80 mol% of linear C₄ and C₆ α-olefins.

26. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and

- (b) a catalyst precursor with the formula of the composition of matter of claim 2, wherein:

M is iron, nickel, or cobalt; and

R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

27. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
(b) a catalyst precursor with the formula of the composition of matter of claim 2 wherein:

M is nickel, iron, or cobalt;

(ii) R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals; and

(iii) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl,

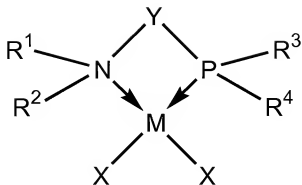
nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

28. (Withdrawn) The composition of matter of claim 27 wherein

- (i) R^1 , R^2 , R^3 , and R^4 are independently selected from methyl, ethyl, and propyl; and
- (ii) Y is selected from butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals.

29. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the following formula:



wherein

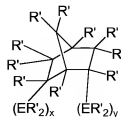
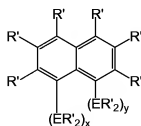
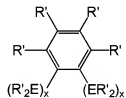
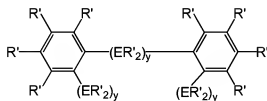
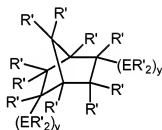
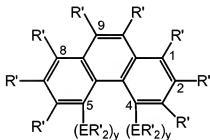
M is a Group-8, -9, or -10 transition metal, excluding palladium,

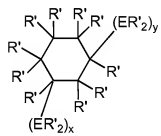
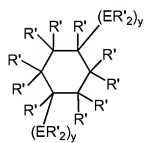
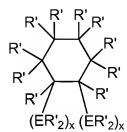
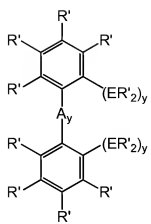
N is nitrogen;

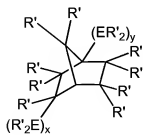
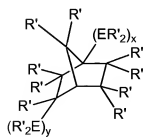
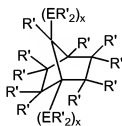
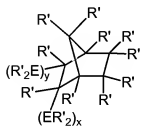
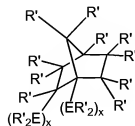
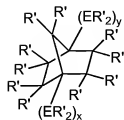
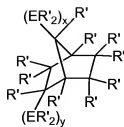
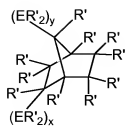
P is phosphorus;

R^1 , R^2 , R^3 , and R^4 are hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

R' are independently, hydrogen or C_1-C_{50} hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4;

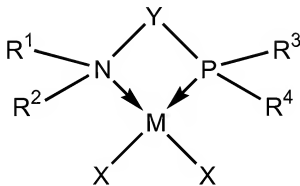
y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, diethylamino, methylethylaminodimethylamin; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

30. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

M is iron, nickel, or cobalt,

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl,

nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

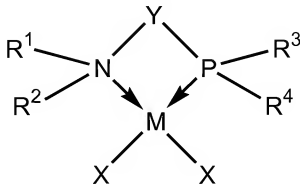
Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penethylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radical; and

(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

31. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

M is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene,

eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penenylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radical; and

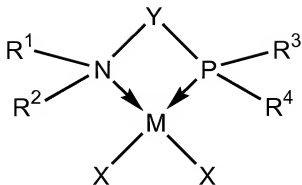
X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

32. (Withdrawn) The polymerization method of claim 31 wherein Y is a biphenyl radical.

33. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

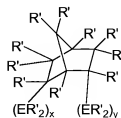
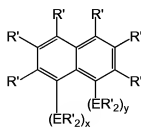
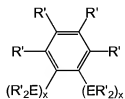
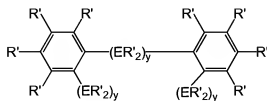
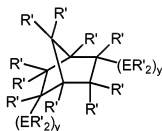
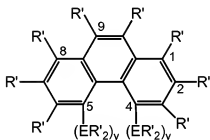
M is a Group-8, -9, or -10 transition metal,

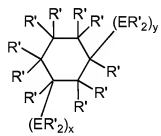
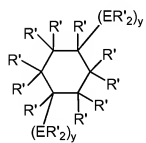
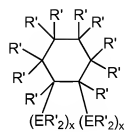
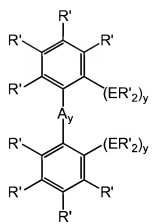
N is nitrogen;

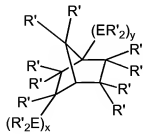
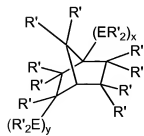
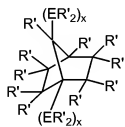
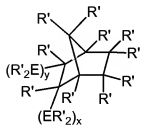
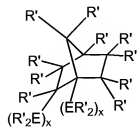
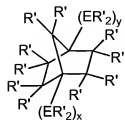
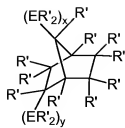
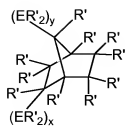
P is phosphorus;

R^1 , R^2 , R^3 , and R^4 are independently hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

R' are independently, hydrogen or C_1 - C_{50} hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4;

y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, chloride, bromide, iodide, or methylethylamino.

IX. APPENDIX: EVIDENCE

1. Canich Declaration dated July 18, 2008.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :	§	Before the Examiner
Zhao et al.	§	James E. McDonough
Serial No. 10/693,584	§	Group Art Unit No. 1793
Filed: October 24, 2003	§	Attorney Docket Number: 2002B130/2
For: Late Transition Metal Catalysts for Olefin Oligomerizations	§	Confirmation Number 1077
Customer No.: 23455	§	Date: July 18, 2008

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Declaration Under 37 C. F. R. § 1.132

Dear Sir:

This affidavit is submitted to offer a showing that Claims 2-6 and 9-16 are both novel and non-obvious over Buchwald (US 6,307,087) in view of Qian (*Synthesis and Polymerization Behavior of Various Substituted Half-Sandwich Titanium Complexes Cp*TiCl₂(OR*) as Catalysts for Syndiotactic Polystyrene*, J. Mol. Cat. 208, 2004, 45-54.).

This declaration is submitted with a response to the Advisory Action dated July 7, 2008, along with an Information Disclosure Statement, as the submission required under 37 CFR § 1.114 for a Request for Continued Examination.

I, Jo Ann Marie Canich, Ph.D. declare that:

1. I am a citizen of the United States residing in Houston, Texas.
2. I am a co-inventor of the above-referenced patent application referred to herein as the '584 Patent Application.

3. I have been continuously employed by ExxonMobil Chemical Company, (and its predecessor Exxon Chemical Company) since 1987 as a research scientist working in the area of olefin catalysis. I have over twenty years of direct experience in the olefin catalysis art and, among other things, have recently published a book (co-editor) in the area of olefin catalysis (*Stereoselective Polymerization with Single-Site Catalysts*, Eds. Baugh & Canich, CRC Press, Boca Raton, FL, 2008). I have won multiple awards both inside my company and from industry for my work in the olefin catalysis field. Additional information regarding my technical and professional background is attached as a *Curriculum Vitae*.

4. I have read the Office Action dated February 22, 2008 and Advisory Action dated July 7, 2008, and have read each of the references cited therein, e.g. Buchwald and Qian.

5. In my opinion one of ordinary skill in the olefin catalysis art reading Buchwald would find that Buchwald is directed to catalysts useful to make small molecules via metal mediated coupling reactions, but not polymerization or oligomerization catalyst compounds. Furthermore, it is my opinion that the reference to "polymers" in Column 1, lines 16-20 is merely a general opening statement regarding the uses of transition metal catalyst compounds. In this sentence located in the "background of the invention" section, Buchwald in no manner implies that the catalysts of his invention are polymerization catalysts. In fact, in searching for the word "polymer", or a derivative of the word polymer, only 6 occurrences are found in the entire 55 page document. The second occurrence is on Column 16, line 56 where Buchwald again has a general statement regarding the use of synthetic schemes for aryl amines, biaryls, alpha-aryl ketones, and the like being useful to the agricultural, pharmaceutical and polymer industries. Again, this is simply a general statement, and in my opinion suggests that the coupling chemistry described in this patent can be used to add functionality to a polymer at most, i.e. performing coupling chemistry with polymers, not using coupling chemistry to make polymers. Furthermore, there is no indication, illustration or exemplification in the entire document that the coupling chemistry can be used to make polymers. Further in my opinion, even if one were to stretch one's imagination to the concept of using the catalysts for making polymer, one would be limited to making polymers containing aryl groups. All four reactions schemes discussed in the patent (see column 10, line 5, column 12, line 5, column 13,

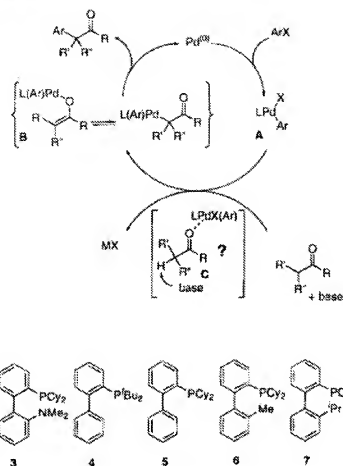
line 30, and column 14, line 60) and also claimed (see claims 19, 38, 50, and 62) involve the coupling of an aryl group to either an amine (Scheme 1), another aryl group (Scheme 2), an alkyl, heteroalkyl, or aralkyl (Scheme 3), or a ketone (Scheme 4). There is no mention or teaching of coupling an alpha-olefin with a second alpha-olefin, and there is certainly no mention of stringing more than two of any molecules together in any of these reaction schemes.

Besides the two occurrences of "polymer" discussed above, the remaining four are clearly related to polymer supports regarding supported Pd catalysts or polymer supported reactants which are typically used in combinatorial chemistry.

6. It is further my opinion that Buchwald does not disclose the pre-catalyst compounds or polymerization catalysts used in my patent application, and only discloses the use of the ligand in combination with a metal and a base such as an alkoxide, amide, phosphate, or carbonate. While the Examiner suggests that the reaction of the ligand with a metal will produce the pre-catalysts of my invention, this is not indicated in or supported by Buchwald.

In fact, if one refers to *Journal of the American Chemical Society* 2000, 122, 1360 (Fox et al.), Fox et al. shows the proposed reaction scheme (Scheme 1, page 1366 - also shown below) for a small molecule coupling reaction where the ligand, L, is shown in the chart on page 1362. The ligand labeled 3 can perform as an ancillary ligand where Y is biphenyl (referring to the formula in Claim 1 of the '584 application). On page 1366, Fox et al. states that in comparison to previous studies, that they believe the Pd:phosphine ratio when using ligands 4-7 for the reaction intermediates (A and B) is 1:1 (i.e. only one electron donating atom, in this case phosphorous, is needed). Note that ligands 4-7 are mono-dentate phosphorus ligands. Additionally, similar evidence suggests that the binding of the dimethylamino group of ligand 3 to Pd is not essential for the catalytic process and, in fact, may not occur at all. This is indicated by the similarities in the catalysis involved when using 3, 6 and 7 in the Pd-catalyzed ketone arylations reported in the paper, in addition to Suzuki and amination reactions reported in references within. Note that ligands 6 and 7 do not contain the dimethylamino group as compared to ligand 3. Hence, it would be speculative at best to assume that the reaction between ligand 3 and a metal would form the polymerization pre-catalyst of my invention, when the chemistry in small molecule coupling reactions suggests otherwise.

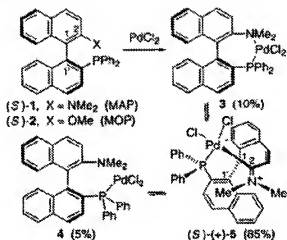
Scheme 1



Fox et al. also states that it is possible that the interaction between the metal and the ligand in the Pd(II) intermediates complexes (A and B) is similar to those reported for the MOP and MAP ligands reported in *Journal of the American Chemical Society* 1999, 121, 7714 (Kocovsky et al.). Kocovsky et al. uses a binaphthyl ligand (not an ancillary ligand in my application). Scheme 1 of Kocovsky et al. is shown below (p 7714). Kocovsky et al. indicates an equilibrium between species **3** (10%), **4** (5%) and **5** (85%) in solution, however, they were only able to isolate compound **5**, suggesting the preferred state of the molecule is complex **5**. This is based not only on the ability to isolate complex **5** in crystalline form which was structurally characterized by X-ray crystallography, but also on the solution equilibrium mixture

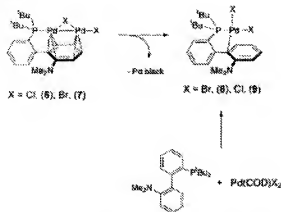
being 85% complex **5**. Note that complex **5**, and also complex **4**, does not have a metal-nitrogen bond as required of my ancillary ligand in the claims. Again, it would be speculative to assume the reaction between the ligand of Buchwald would react to make the complexes of our application verses assuming other chemistry as suggested by Kocovsky.

Scheme 1



Also noteworthy, is *Journal of the American Chemical Society* 2006, 128, 6376 (Christmann et al.) where reaction Scheme 3 illustrates two routes in making a palladium dihalide complex bearing a 2'-(di-tert-butylphosphino)-N,N'-dimethylbiphenyl-2-amine ancillary ligand. Note that the reaction of the ligand with $\text{Pd}(\text{COD})\text{X}_2$ where X is chlorine or bromine and COD is cyclooctadiene produces the Pd complexes labeled **8** and **9** wherein the Pd metal center is not bonded to the amine functionality of the ancillary ligand. Christmann et al. characterized complex **8** by X-ray crystallography, and both complexes were characterized by NMR.

Scheme 3



One should also note that the catalysis scheme for making small molecules via metal mediated catalysis as shown in Fox et al.'s Scheme 1 involves (1) starting with a Pd(0) complex and oxidizing it to Pd(II) by ArX to form intermediate A; (2) forming an interaction between intermediate A and an electron donor (a ketone in this case) in the presence of a base to form intermediate C; (3) abstraction of an acidic proton by the base to form intermediate B; and finally (4) reduction of intermediate C (Pd(II) down to Pd(0)) and formation of an arylated ketone. This is a catalytic cycle that involves multiple Pd species, and requires the ability to oxidize the metal to a higher oxidation state in order for the chemistry to occur, and then reduce the Pd back to Pd(0) to regenerate the catalyst and to "release" the new compound. The coupling mechanism for Buchwald is analogous to that represented by Fox et al. This is why Buchwald states in Column 32, line 7-8 that "the metal center is desirably in the zero-valent state or is capable of being reduced to metal (0)". The nickel and palladium species in my application are Ni(II) and Pd(II) and the catalytic cycle for olefin polymerization/oligomerization does not involve changing the oxidation state of the catalyst precursor, or of the catalyst species during the polymerization / oligomerization reaction.

7. Also interesting and noteworthy is that only nickel complexes bearing the 2'-(dihydrocarbyl-phosphino)-*N,N*-dihydrocarbyl-biphenyl-2-amine ancillary ligand recognized to date (July 11, 2008) by the Chemical Abstract Service (CAS) are [2'-(diphenylphosphino)-*N,N*-dimethylbiphenyl-2-amine]nickel(II) dibromide and [2'-(dicyclohexylphosphino)-*N,N*-dimethylbiphenyl-2-amine]nickel(II) dibromide

bearing registry numbers 685517-32-2 and 685517-31-1, respectively. The only references to these compounds are WO 2004/037869 and WO 2004/037837 which are related to my US '584 application. Also, while CAS now includes prophetic compounds in the registry as of Dec 12, 2007, these registry numbers and references are prior to the implementation of including prophetic compounds. Thus another in the art (i.e. the CAS) only recognized my art in the above referenced patent applications, and specifically not Buchwald, to have made the metal complexes as claimed in my '584 application.

8. It is further my opinion that Qian is directed to polymerizing styrene, not to oligomerizing or polymerizing alpha-olefins as in my application. As such, a trend seen in Qian can not necessarily be equated with a different type of polymerization process. Qian is focused on changing the Cp' or R* of Cp'TiCl₂(OR*). Qian states, "In order to study how the changes of pi-donor ligand and sigma-donor ligand affect the catalytic activity and the properties of s-PS, this work aims to design and prepare a series of Cp'TiCl₂(OR*) complexes with different substituents in Cp and OR*, and then to apply them to the production of s-PS." Since Cp'TiCl₃/MAO is known to be a styrene polymerization catalyst, perhaps the Examiner is comparing the OR* of Qian to Cl, but OR* is not a hydrocarbyl, nor is it an abstractable ligand/leaving group in this catalyst system. The conclusion in Qian states, "through the polymerization testing we can conclude that the environment of cyclopentadiene plays a major role in the series of Cp'TiCl₂(OR*)/MAO catalytic systems, and that the influence of OR* is relatively weak." Qian's conclusion does not mean that R* has little effect, it means that in comparison to changing the substituents on the Cp ring, it has little effect for the polymerization of styrene.

Furthermore, it is commonly known in polymerization catalysis that changing the leaving group can affect catalyst activity, polymer molecular weight, and when applicable, polymer tacticity. For example, Kaminsky et al. reported that the styrene polymerization activity of fluorinated complexes Cp'TiF₃/MAO (Cp' = Cp, Cp*, MeCp, EtMe₂Cp, etc.) was about 30-40 times higher than with analogous Cp'TiCl₃/MAO systems. The polymer molecular weight, melting point and syndiotacticity were also significantly higher. This higher activity and syndioselectivity of the fluoride catalysts as compared to the chloride analogs is attributed to a greater number of more stable Ti(III) active sites where the fluoride

would be expected to better stabilize the Ti(III) oxidation state. See *Macromolecules* 1997, 30, 7647-7650. Similarly, in ethylene polymerization, McCullough et al. in US 6,632,901 report higher activity with $\text{Cp}^*_2\text{ZrF}_2$ is used as compared to $\text{Cp}^*_2\text{ZrCl}_2$ ($\text{Cp}^* = 1,3\text{-Me}_2\text{BuCp}$, Me_6Cp , $n\text{-PrCp}$, etc.) Similarly, Pedetour et al. (*Journal of Molecular Catalysis A: Chemical* 2001, 176, 87-94) studied the effect of the leaving group for $\text{rac-Et(Ind)}_2\text{ZrX}_2$ where X, the leaving group, was Cl, Me, NMe_2 or CH_2Ph . In this study, it was found that when X was hydrocarbyl (Me or CH_2Ph) that catalyst activity was not dependent on the MAO to pre-catalyst molar ratio (Al:Zr) over the range of about 150-2000. This was not the case for the Cl leaving group where the activity differed significantly from low Al:Zr of 150 (activity = 0) to a higher Al:Zr of 2000 (activity = 1290 kg/mol-hr). This study clearly shows that for a polymerization catalyst leaving group, hydrocarbyl is not equivalent to halide. Probably more relevant is US 7,247,687 (Cherkasov et al.) which deals with late transition metal polymerization catalysts. Cherkasov et al. demonstrate that the [1,4-bis-substituted)-1,4-diaza-1,3-butadiene]nickel(II) catecholate complexes are very different catalysts as compared to the dibromide analogs. Note that the two differ in the X leaving groups - two bromides vs. a chelating catecholate ligand. The dibromide complexes are known paramagnetic and typically hydrocarbon insoluble complexes while, the catecholate analogs are diamagnetic and hydrocarbon soluble (see column 2 for a discussion on paramagnetic complexes in the Background section and diamagnetic complexes in the Summary section). Comparison of the polymerization of a catecholate based catalyst vs. corresponding dibromide based catalyst (compare entries 8-11 with C6-C7 in Table 1, column 308) shows the catecholate to give higher activity as compared to the dibromide. While this study did not compare hydrocarbyl to halide, it does show that the nature of the leaving group affects catalyst activity in late transition metal catalyzed olefin polymerizations.

Since many examples exist to show that the leaving groups in olefin polymerization catalysis can have a major affect on catalyst activity, one skilled in the art would not assume that a hydrocarbyl leaving group is the same as a halogen leaving group in a nickel based catalyst system.

9. It is my further opinion that halogen ligands and hydrocarbyl ligands are not equivalent in all catalyst systems at all times. First halogen ligands are considered electron withdrawing, whereas hydrocarbyl ligands are typically

considered electron donating. Second, in many systems, a borate activator in combination with a halogenated catalyst precursor (e.g. Cp_2ZrCl_2) produces an inactive system while an alkylated precursor (e.g. Cp_2ZrMe_2) will likely, but not always, produce an active system. Thus, halogens and hydrocarbyls are not equivalent, particularly in borate activator containing systems.

10. In light of this lack of equivalence and the other statements above, it is my opinion that one of ordinary skill in the art would not combine Buchwald and Qian because firstly Qian is not directed at comparing hydrocarbyl verses halogen leaving groups, but is a study of ligand substitution on mono-cyclopentadienyl titanium catalysts for styrene polymerizations; and secondly, Buchwald is not directed to olefin polymerization catalysis, but rather to small molecule synthesis using late transition metal mediated coupling chemistry.

11. At the time the '584 application was filed, very few complexes used in catalyst systems were known that combined good catalyst activity with the production of linear olefins, with a particular preference for lower alpha-olefins. Additionally, the hydrocarbon solubility of my complexes (i.e. catalyst precursors) allowed for readily supporting the complexes to produce supported catalysts which can have advantages in certain processes, for example, a fixed bed process. And it is possible (but yet unproven) that the reason behind the unusual catalysis of my catalyst system, is that most four-coordinate Ni(II) complexes prefer the planar geometry since the planar ligand set allows for the d-electrons to avoid occupying antibonding orbitals. My Ni(II) four-coordinate complexes were determined to be tetrahedral in geometry meaning that d-electrons occupying the antibonding orbitals is unavoidable, hence the fact that these complexes are also paramagnetic.

12. In light of the above, it is my opinion as one of ordinary skill in the art that the foregoing clearly indicates that the catalyst described and claimed in my '584 Patent Application represents a technological break-through as perceived by those skilled in the field of transition metal catalysis.

13. *I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both.*

under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent.

Date: July 18, 2008


Jo Ann Marie Canich, Ph.D.

CURRICULUM VITAE

JO ANN MARIE CANICH

Office Address: ExxonMobil Chemical Company
Baytown Technology and Engineering Complex - West
5200 Bayway Drive
Baytown, TX 77520

Industrial Positions:

- ExxonMobil Chemical Company – Core Technology
 - Product Technology, Organometallic Catalysis Group (11/07-present)
 - Team Leader - Block Copolymers Team 1/08-present
 - Catalysis Process R&D, Organometallic Catalysis Group (1/07-11/07)
- Univation Technology: Catalyst R&D (1/04-1/07)
- Exxon or ExxonMobil Chemical Company – Core Technology
 - Catalysis Process R&D, Organometallic Catalysis Group (6/02-12/03)
 - Intellectual Property Coordination (12/02-12/03)
 - Polymer Science Division, Catalysis & Process Science Group (5/99-5/02)
 - Polymer Science Division, Solid State and Molecular Modeling Group (1/96-4/99)
 - Team Leader - Exploratory Catalyst Team 1/96-12/97
 - Team Leader - Solution Metallocene Elastomers Team (1/98-12/98)
 - Exxpol Catalysis Group (2/93-1/96)
 - Polymer Science Division, Catalysis Group (9/87-2/93)

Awards:

- ExxonMobil Chemical Company - CPR&D Research Award 2003
- American Society of Patent Holders Distinguished Corporate Inventors 1998
- Exxon Chemical Polymers Technology Award 1997
- Exxon Chemical, Baytown Polymers Center, Extra Mile Award 1995
- Exxon Chemical, Polymer Science, Where the Tire Meets the Road Award 1990
- Iota Sigma Pi National Anna Louise Hoffman Award 1987

Education:

8/84 - 5/87 Texas A&M University
College Station, Texas
Ph.D. Inorganic Chemistry (8/87)
Advisor: F. A. Cotton
Thesis: Oxidative Addition Chemistry of Group V and VI Metal Dimers

9/77 - 7/84 Portland State University
Portland, Oregon
M. S. Chemistry (6/84)
B. S. Chemistry (6/81)
Advisor: G. L. Gard
Thesis: Derivatives of Trifluorosulfur Pentafluoride and F-(tert-butyl)
Hypochlorite

Publications:

Stereoselective Polymerization with Single-Site Catalysts, Baugh, L.S., Canich, J.M., Eds.; CRC Press: Boca Raton, FL, 2008.

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Copolymers of Ethylene and 2-Butenes using Cp-Amido Titanium Catalysts J. M. Canich NSF Inorganic Chemistry Workshop, Blaine, Washington, June 2006

Single-Site Catalysts for Olefin Polymerization J. M. Canich Florida Institute of
Technology, Melbourne, Florida, March 1998 (Oak Ridge Associated Universities
Visiting Industrial Scholar)

Single-Site Catalysts for Olefin Polymerization J. M. Canich Southwest Regional
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Single-Site Catalysts for Olefin Polymerization J. M. Canich Inorganic Gordon
Conference, Henniker, New Hampshire 1996

Organometallic Approaches to Ziegler-Natta Polymerizations of Olefins J. M. Canich NSF Organometallic Workshop, Queenstown, MD 1995 (Note: This was
a different talk than the previous ones with the same title.)

Organometallic Approaches to Ziegler-Natta Polymerizations of Olefins J. M. Canich Contemporary Inorganic Chemistry: A symposium in Honor of F. A.
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previous one with the same title.)

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X. APPENDIX: RELATED PROCEEDINGS

USSN 10/692,827, filed October 24, 2003 is also under appeal, no decisions have been reached as of the filing date of this Brief.

XI. APPENDIX: AMENDMENT TO REDUCE ISSUES ON APPEAL
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 10/693,584 Confirmation No.: 1077
Applicant(s) : Baiyi ZHAO et al.
Filed : October 24, 2003
TC/A.U. : 1793
Title : *Late Transition Metal Catalysts for Olefin Oligomerizations*
Examiner : James E. McDONOUGH
Docket No. : 2002B130/2
Customer No. : 23455
Date : December 23, 2009

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

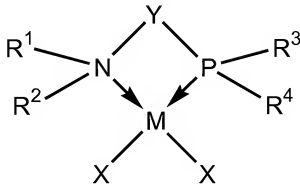
AMENDMENT SUBMITTED UNDER 37 C.F.R. § 1.116

This amendment is submitted concurrently with an Appeal Brief to reduce the issues on appeal.

IN THE CLAIMS

Please enter the following amendments

1. (Cancelled)
2. (Previously Presented) A composition of matter with the following formula:



wherein

M is iron, cobalt, or nickel;

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are hydrocarbaryl radicals;

Y is a hydrocarbaryl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclododecylene, cyclododecylene, biphenyl, butenylene, penenylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals; and

(f) each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate; or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

3. (Previously Presented) The composition of matter of Claim 2 wherein R¹, R², R³, and R⁴ are C₁-C₄₀ hydrocarbyls.

4. (Previously Presented) The composition of matter of Claim 3 wherein R¹, R², R³, and R⁴ are C₁-C₃₀ hydrocarbyls.

5. (Previously Presented) The composition of matter of Claim 4 wherein R¹, R², R³, and R⁴ are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

6. (Previously Presented) The composition of matter of Claim 5 wherein R¹, R², R³, and R⁴ are methyl, ethyl, propyl, butyl, cyclohexyl, phenyl, tolyl, benzyl, or phenethyl.

7. (Cancelled)

8. (Cancelled)

9. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are dimethylamino, diethylamino, methylethylamino, phenoxy, or benzoxy.

10. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, or tolyl.

11. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently allyl, or 1,1-dimethyl allyl.

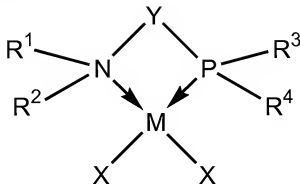
12. (Cancelled)

13. (Currently Amended) The composition of matter of Claim 2 ~~42~~ wherein M is nickel.

14. (Currently Amended) The composition of matter of Claim 2 ~~42~~ wherein both X groups are a chloride, bromide or iodide.

15. (Previously Presented) The composition of matter of Claim 2 wherein Y is biphenyl.

16. (Previously Presented) A composition of matter with the following formula:



wherein

M is nickel, cobalt or iron,

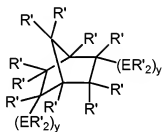
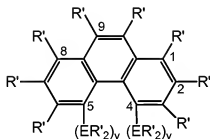
N is nitrogen;

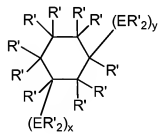
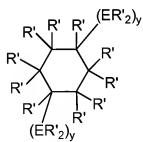
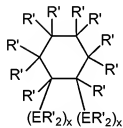
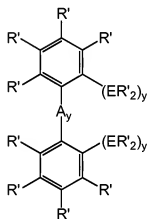
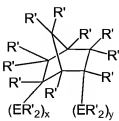
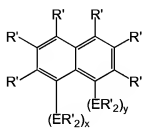
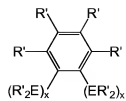
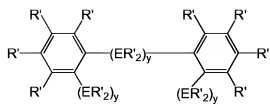
P is phosphorus;

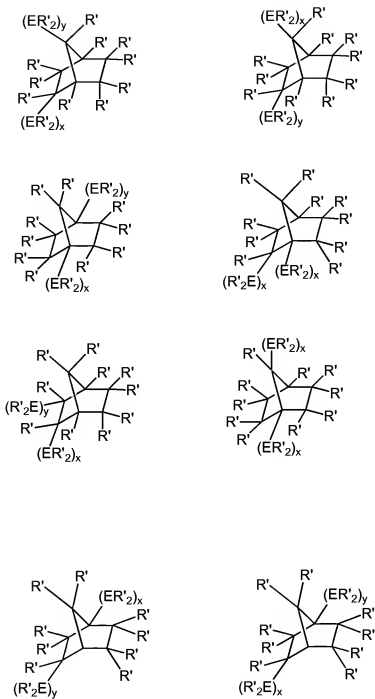
R^1 , R^2 , R^3 , and R^4 are hydrocarbonyl radicals;

each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate, or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene; and

Y has one of the following formulas:







where

R' are hydrogen or C₁-C₅₀ hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4; and

y is an integer from 0 to 4.

17. (Previously Presented) The composition of Claim 16 wherein A is C=O, C=S, O, S, SO₂, NR*, PR*, BR*, SiR*₂, or GeR*₂ wherein each R* is a hydrocarbyl or halocarbyl radical.

18. (Withdrawn) A composition of matter comprising the reaction product of an activator and the composition of matter of Claim 2.

19. (Withdrawn) A composition of matter comprising the reaction product of

- (a) the composition of matter of Claim 18 and
- (b) ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

20. (Withdrawn) A polymerization method comprising the step of providing at least one composition of matter of Claim 2.

21. (Withdrawn) The polymerization method of Claim 20 wherein the activity of the composition of matter exceeds 8000 moles of ethylene per mole transition metal per hour.

22. (Withdrawn) The polymerization method of Claim 20 further comprising recovering a product comprising greater than 50 wt% of linear C₄-C₁₄ α-olefins based on the total weight of polymerized product.

23. (Withdrawn) The polymerization method of Claim 22 wherein the product comprises greater than 80 wt% of linear C₄-C₁₄ α-olefins.

24. (Withdrawn) The polymerization method of Claim 23 wherein the product comprises greater than 50 wt% of linear C₄ and C₆ α-olefins.

25. (Withdrawn) The polymerization method of Claim 24 wherein the product comprises greater than 80 mol% of linear C₄ and C₆ α-olefins.

26. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and

- (b) a catalyst precursor with the formula of the composition of matter of claim 2, wherein:

M is iron, nickel, or cobalt; and

R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

27. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
(b) a catalyst precursor with the formula of the composition of matter of claim 2 wherein:

M is nickel, iron, or cobalt;

(ii) R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals; and

(iii) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl,

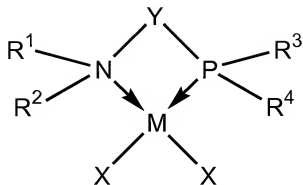
nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

28. (Withdrawn) The composition of matter of claim 27 wherein

- (i) R^1 , R^2 , R^3 , and R^4 are independently selected from methyl, ethyl, and propyl; and
- (ii) Y is selected from butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals.

29. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the following formula:



wherein

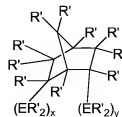
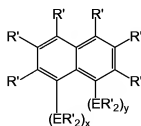
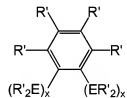
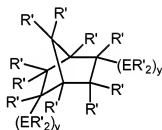
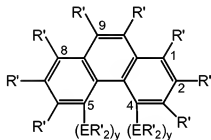
M is a Group-8, -9, or -10 transition metal, excluding palladium,

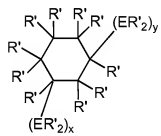
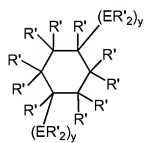
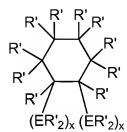
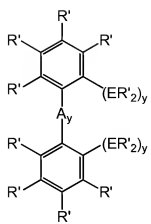
N is nitrogen;

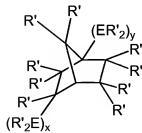
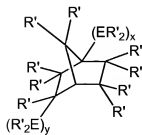
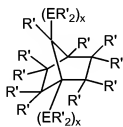
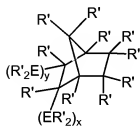
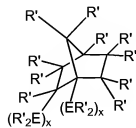
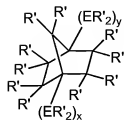
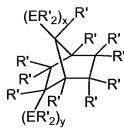
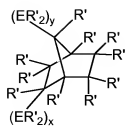
P is phosphorus;

R^1 , R^2 , R^3 , and R^4 are hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

R' are independently, hydrogen or C_1-C_{50} hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4;

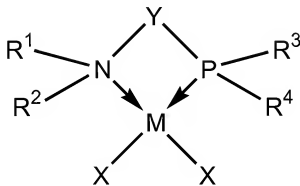
y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, diethylamino, methylethylaminodimethylamin; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

30. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

M is iron, nickel, or cobalt,

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl,

nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

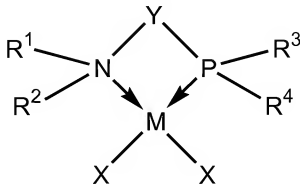
Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penethylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radical; and

(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

31. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

M is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene,

eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penenylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radical; and

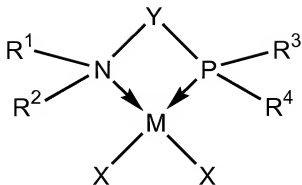
X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

32. (Withdrawn) The polymerization method of claim 31 wherein Y is a biphenyl radical.

33. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

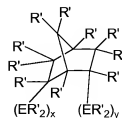
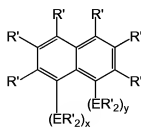
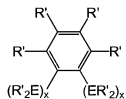
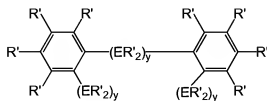
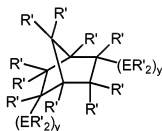
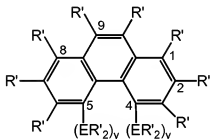
M is a Group-8, -9, or -10 transition metal,

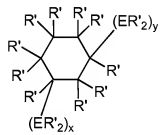
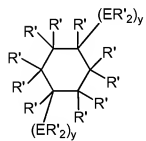
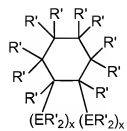
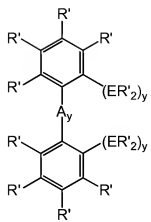
N is nitrogen;

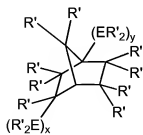
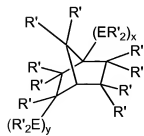
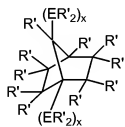
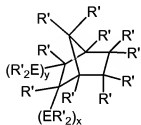
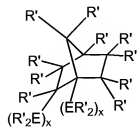
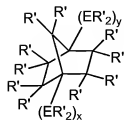
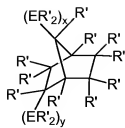
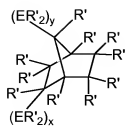
P is phosphorus;

R¹, R², R³, and R⁴ are independently hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

R' are independently, hydrogen or C_1 - C_{50} hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4;

y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, chloride, bromide, iodide, or methylethylamino.

REMARKS

This amendment is submitted concurrently with an Appeal Brief to reduce issues on appeal.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and respectfully requests notice of such.

Please charge any deficiency in fees or credit any overpayments during the entire pendency of this case to Deposit Account No. 05-1712. Please also charge any petition fees, including fees for extensions of time necessary for the pendency of this case or copendency of this application with another application at any time to Deposit Account No. 05-1712.

Respectfully submitted,

Date: December 23, 2009

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